DOCUMENT RESUME

ED 234 218 CE 036 963

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TITLE Review and Update Contents of Drafting Curriculum Guides. Final Report.
INSTITUTION Southwest Missouri State Univ., Springfield.
SPONS AGENCY Missouri State Dept. of Elementary and Secondary Education, Jefferson City. Div. of Career and Adult Education.
PUB DATE May 83
NOTE 42p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Computer Oriented Programs; *Course Content; Curriculum Evaluation; Curriculum Guides; Curriculum Research; *Drafting; *Educational Change; *Educational Needs; Futures (of Society); Influences; Job Skills; Metric System; Postsecondary Education; Questionnaires; *Relevance (Education); Secondary Education; Surveys; *Technical Education; Technological Advancement
IDENTIFIERS Dimensioning (Mechanical Drawing)

ABSTRACT

A study was undertaken to determine whether the curriculum guides presently being used in drafting courses have changed due to the technological developments that have occurred in industry. In addition, the survey was concerned with the extent that knowledge of geometric dimensioning and tolerancing are needed by drafters, the extent that the metric system is used in industry, and the nature of the use of computer applications by drafters. Based on data from survey instruments that were completed by 126 randomly selected members of the American Institute for Design Drafting, it was determined that although the methods of reproducing and storing drawings are changing and will change even more in the next few years, the basic content and knowledge needed by drafters has not. In response to questions relating to the need for and use of geometric dimensioning and tolerancing, 38 percent of the population felt that these were important job skills. As to the need for and use of computer applications in the drafting room, 41.8 percent of the respondents indicated that they were used for graphic assistance. While many mechanical and electromechanical drafters used the metric system in their work, respondents in the other seven areas of the drafting industry indicated little or no need for a knowledge of metrics. (The questionnaire is appended.) (MN)

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MO 8313104

ED234218

FINAL REPORT

Review and Update Contents of Drafting Curriculum Guides

Prjoect No. 83-131/132-600-1(119-119)(B)

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May 1983

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ABSTRACT

The purpose of the study was to determine if the basic contents of drafting had changed, brought about by the technological development of industry, and if these new procedures will affect basic drafting courses. The survey was also concerned to what extent the knowledge of geometric dimensioning and tolerancing was needed by drafters, to what extent was metrics used in industry, and the use of computer applications by drafters.

To gain as much information as possible from as diverse a group as industrial drafters, the membership of the American Institute of Design Drafting was used to draw to population for the study. The specific population for the study was a random sample of the members of AIDD. Two hundred and seventy-seven questionnaires were sent out with 126 usable responses returned.

Those respondents answering the questionnaires represented nine different industrial areas. In response to questions relating to the need and use of geometric dimensioning and tolerancing, 38 percent of the population indicated it was important to know as job skills. However, the positive responses came mostly from mechanical and electro-mechanical areas of industry. As to need and use of computer applications in the drafting room, 41.8 percent of the respondents indicated they were used for graphic assistance. However, 81 percent indicated they would be using more computer applications in the next 5 years. Computer applications did not require a change in drafting procedures and the best computer graphic personnel were former drafters. Mostly mechanical and electro-mechanical drafters indicated a need for knowledge and use of metrics, 42 percent of the respondents. The other seven areas of industry responding to the survey indicated little or no need for metrics.

Although the methods of reproducing and storing drawing is changing and will change more in the next few years, the basic content and knowledge needed by the drafter had not. This basic knowledge will only be handled differently because of the hardware and resulting software that is and will be available. Some new procedures, such as geometric dimensioning and tolerancing and metric, will probably be required knowledge by more drafters, but are still not extensively used by the industry.

A study of greater depth and broader in scope may be of value to discern specific needs in special areas of industry. Schools should turn more to computer graphics as a method of producing drawing and a source of storing and reproducing drawing. These methods should completely replace the drafting table and normal drafting equipment when the price of computers and computer graphic equipment becomes more affordable.

PROBLEM

The one essential thread woven into any vocational technical pre-employment training program is the ability to be literate in the language of industry. All vocational-technical graduates must, at some point in their training, learn to read and, in some cases, make drawings of work to be done in order that they and others can communicate their ideas and the intent of the job. This communication, between the design engineer, the drafter, and the people on the job is in the form of scale drawings. It is a standard practice of any major company of all industries that any object to be made must have well drawn and reproducible scale drawings.

In recent years, with the continual advancement of the industrial technique into high technology, the problem of presenting ideas and job description in the form of working drawings may be changing. These new production processes and machines call for newer and more effective methods of object size and shape description and presentation.

It was the intent of this study to determine if drafting procedures and practices, currently used in industry, have changed sufficiently to warrant a re-evaluation of the drafting technology content presented in drafting classes providing training for students enrolled in vocational-technical programs. The study's intent was to survey industries and technical school graduates to gain the data needed to obtain the research objectives.

More specifically, the survey intended to find out to what degree different industries are using geometric dimensioning and tolerancing as a method of size description, computer-aided drafting to alleviate time-consuming drawing, metrication as a method of numeration and size description, and if there are other areas of drafting that are changing.

These topics seem to be a concern to the American Institute for Design Drafting. In review of convention presentations in the last seven years, these

topics have repeatedly been discussed. The purpose of this study was to determine how extensive these topics should affect the vocational-technical school drafting classes and their inclusion into the present curriculum, and to determine if new drafting techniques and information needs to be incorporated into the drafting curriculum.

The following specific objectives were used in developing the questionnaire to accomplish the purpose of the study.

OBJECTIVE #1

TO DETERMINE IF NEW SHAPE DESCRIPTION TECHNIQUES OF OBJECTS ARE USED TO MEET THE NEEDS REQUIRED BY NEW MACHINES AND PROCESSES USED IN INDUSTRY TODAY.

The information drawn from the Table I, of the items listed in the questionnaire and comments of those drafters responding to the questionnaire, indicates the current techniques used in industry to determine the shape description of drawings and views of objects do not differ from standard drafting procedures currently taught in drafting technology classes. Even when using computers and CRT facilities, the basic knowledge of shape description is still needed and has not been changed by the new hardware or software.

The responses to the survey were found to be from eight different industrial areas using drafters. Even with a relatively homogeneous group as drafters it is difficult to group them into neat categories of industrial activity. Although some of the respondents to the survey indicated their company's activities crossed several fields of technology, the area in which the company might tend to emphasize as their area of greatest expertise determined the area in which it was placed. These industrial areas were: Electrical, Mechanical, Geological Cartography, Structural, Architectural, Civil, and Electro-Mechanical. The survey indicates that 63.6 percent of the respondents considered orthographic projection as essential knowledge for doing their work, and the most important method of shape description still in use.

With the advent of the computer and the initiation of computer graphics into the drafting room, it is becoming more common to find drafters as computer programmers and operators projecting shapes of objects onto a CRT screen than sitting at a drafting table drawing lines on drafting vellum. However, it is still necessary for the drafter/computer programmer to know and use the basic principles of shape description, the theory of projection, and conventions of drafting technology.

OBJECTIVE #2

TO DETERMINE HOW EXTENSIVELY SHOULD THE CHANGES IN BASIC DRAFTING COURSES BE TO REFLECT THE APPLICATION OF NUMERICAL CONTROL PROCESSES AND COMPUTER GRAPHICS.

Those individuals contacted and replying to the questionnaire indicated that numerical control processes were a matter of programming and not drafting, and normally would not require changes in the methods and procedures of teaching drafting. Those industries using the graphics generated by the computer had eliminated drafters almost completely from their organization, and had, in most cases, retrained the drafters to be computer programmers using the knowledge of the drafter to program the computer to do the graphics presently required of the company.

Numerical control and computer graphics use basically a coordinated system of point projection as a basis for their programming. Of those industries using numerical control and computer graphics, the majority were found in Geology and Mechanical. Each area indicated that it was important or very important to their work to know and use point projection. Thirty-two percent of the entire population studied indicated that point projection was used in their occupational area or needed to be known in doing their work.

OBJECTIVE #3

TO DETERMINE HOW EXTENSIVELY THE INDUSTRIES, AND IN WHICH INDUSTRIES, USE GEOMETRIC DIMENSIONING AND TOLERANCING AS A METHOD OF SIZE DESCRIPTION IN INDUSTRIAL DRAWINGS.

Of the total population answering the questionnaire, relating to this objective, 35.6 percent indicated it was important to know about geometric dimensioning and tolerancing in their work. Geometric dimensioning and tolerancing is a specialized method of size description that has come to be of value to those industries where numerical control and programmable machines are used to cut and shape objects and parts in the work to be done. The area of Mechanical and Electro-Mechanical indicated geometric dimensioning and tolerancing was important to know and was used in their work. Of the Mechanical, over 64.7 percent indicated geometric dimensioning and tolerancing as important or very important. None of the other areas surveyed indicated that geometric dimensioning and tolerancing was important or needed for their work.

OBJECTIVE #4

TO DETERMINE HOW RELEVANT TO TODAY'S INDUSTRIAL TECHNIQUE IS THE CONTENT OF CURRENT TEXTBOOKS TO THE NEEDS OF VOCATIONAL-TECHNICAL SCHOOL GRADUATES IN PREPARING THEM FOR EMPLOYMENT.

A comparison of contents of current texts and the totals of Table I, shown in Table II, will offer some insight into this objective. Table II indicates the total results of the questionnaires returned from the population surveyed and the summary of like items and the extent to which the item was treated in several major texts currently on the market. In an analysis of the content of current texts, an absolute figure could not be identified as meaningful. Any item covered in the questionnaire may be dealt with extensively in a text in order that the student learn the knowledge or procedure, but not indicated, in the survey, as nearly as important but still need to be known information on the job. Therefore, in Table II an effort has been made to indicate how extensively the material was handled in the number of pages of text and illustrations to items that are only mentioned in a brief paragraph. Those indicated as more than 50 percent of the population surveyed said the knowledge

was important to their work and was also covered in the texts. In a few instances, some texts were completely void of information that was indicated by the population of the study as important to know to perform their jobs. Some specialized areas would obviously not be used as needed occupational information by industry and may be covered extensively in texts that specialize in other areas.

OBJECTIVE #5

TO DETERMINE IF THE DRAFTING CURRICULUM GUIDES PRESENTLY BEING USED BY VOCATIONAL-TECHNICAL TEACHERS SHOULD BE REVISED TO INCLUDE NEW AND EMERGING DRAFTING PROCEDURES.

The comparison of the content of curriculum guides and the results of the survey of job skills and knowledge needed by industry compare favorably regardless of the fact that there is no evidence in written material that such a study has been done. Apparently, enough of the authors of current texts keep in touch with the industry to know what is going on. However, in some areas, the textbook authors are far ahead of the industrial use of the material, such as metrics and some forms of dimensioning.

POPULATION

Because of the uncertainty of the number of responses that can be expected from a mail-out questionnaire, it is imperative to select a population that will be typical of the industrial drafter, that would provide the needed information, and will return the questionnaire. For this study it was felt, by the investigator, that the population should have previously shown some professionalism and be concerned with the development of their field of expertise.

For these reasons the membership of the American Institute of Design Drafting was chosen as the organization from which the sample could be drawn. The national office of AIDD was contacted and a random sample of their membership was drawn for the population of the study. A cover letter was sent with

the questionnaire, signed by both the investigator and the current president of AIDD, and a self-addressed, stamped envelope was enclosed. Two hundred and seventy-seven members were included in the sample. Of those who were contacted, 128 questionnaires, or 51 percent, were returned.

CONCLUSIONS AND RECOMMENDATIONS

Most studies dealing with drafting have to do with the techniques of teaching drafting and not the content of drafting books and drafting classes. This study differs in that it was concerned with the content of drafting books, curriculum guides, and class content as related to industrial practices and problems and how these practices would affect current drafting practices provided in the classroom. This study was not meant to be a comprehensive study to cover all facets of the graphic arts, nor did the population selected intend to be as comprehensive as a study of a larger size would provide. The study was more in the form of a planning study to see if there was a problem that needed deeper study and how these newer techniques of shape and size description and electronic hardware and software were affecting the drafting area.

Although the methods of reproducing and storing drawing is changing and will change more in the next few years, the basic content and knowledge needed by the drafter has not. This basic knowledge will only be handled differently because of the hardware and resulting software that is and will be available. Some new procedures, such as geometric dimensioning and tolerancing and metric, will probably be required knowledge by more drafters, but are still not extensively used by the industry.

A study of greater depth and broader in scope may be of value to discern specific needs in special areas of industry. Schools should turn more to computer graphics as a method of producing drawing and a source of storing and

reproducing drawing. These methods should completely replace the drafting table and normal drafting equipment when the price of computers and computer graphic equipment becomes more affordable.

DISCLAIMER

The activity which is the subject of this report was supported in whole or in part by funds from the Department of Elementary and Secondary Education, Division of Career and Adult Education. However, the opinions expressed herein do not necessarily reflect the position or policies of the Missouri Department of Elementary and Secondary Education or the Division of Career and Adult Education, and no official endorsement should be inferred.

TABLE I

NUMBER & PERCENTAGE OF POSITIVE RESPONSES TO QUESTIONNAIRE BY ITEM AND BY TECHNOLOGICAL AREA

	ARCHITECTURAL N=9	CIVIL N=11	ELECTRICAL N=4	ELECTRO-MECHANICAL N=34	GEOLOGICAL N=8	GEOLOGICAL CARTOGRAPHY N=11	MECHANICAL N=17	PIPING N=6	STRUCTURAL N=14	ALL RESPONSIBILITIES N=10	TOTAL N=124	
INSTRUMENTS	%	%	%	%	%	%	%	%	%	%	No.	%
Drafting Tape	66.7	81.8	25	44.1	75	72.7	52.9	50	57.1	40	69	55.6
Thumbtacks	0	0	0	0	0	0	0	0	0	0	0	0
Templates	77.8	100	100	85.3	100	81.8	88.2	100	64.3	80	106	85.5
Alphabet of Lines	66.7	45.5	50	20.6	62.5	45.5	70.6	66.7	50	30	56	45.2
Proportional Dividers	11.1	9.1	0	1.2	50	36.4	23.5	16.7	28.6	10	24	19.4
Pencil Pointer	66.7	45.5	50	44.1	37.5	45.5	64.7	66.7	64.3	30	63	50.8
Wood Pencil	22.2	0	0	11.8	12.5	9.1	0	16.7	21.4	0	12	9.7
Mechanical Pencil	100	81.8	75	64.7	62.5	90.9	88.2	83.3	78.6	50	94	75.8
Pencil Tracing	55.6	54.5	100	32.4	37.5	45.5	35.3	50	57.1	10	52	41.9
SCALES												
Metric Scales	11.1	27.3	25	20.6	37.5	9.1	47.1	33.3	21.4	20	31	25
Engineers Scales	88.9	100	100	61.8	75	72.7	70.6	66.7	71.4	80	92	74.2
Architects Scales	88.9	90.9	75	29.4	12.5	63.6	35.3	83.3	85.7	80	70	56.5
Decimal Scales	22.2	27.3	75	70.6	25	18.2	70.6	33.3	28.6	60	60	48.4
Mechanical Engineers Scales	11.1	27.3	100	47.1	25	27.3	58.8	16.7	21.4	30	46	37.1
Drafting Machine	33.3	100	100	70.6	87.5	63.6	94.1	33.3	57.1	70	89	71.8
Parallel Bars	66.7	36.4	25	14.7	25	36.4	17.6	83.3	50	30	40	32.3
Drawing Paper	77.8	63.6	100	73.5	87.5	72.7	70.6	83.3	92.9	40	92	74.2
INKING												
Technical Pen	66.7	90.9	50	50	100	72.7	41.2	50	57.1	80	77	62.1
Tracing in Ink	22.2	81.8	25	26.5	100	63.6	23.5	33.3	50	60	55	44.4

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LETTERING	%	%	%	%	%	%	%	%	%	%	No.	%
Guide Lines	77.8	81.8	100	55.9	50	36.4	82.4	66.7	57.1	50	78	59.7
Vertical Letters	66.7	72.7	50	38.2	87.5	54.5	64.7	66.7	57.1	50	70	56.5
Slant Letters	22.2	45.5	25	14.7	75	54.5	35.3	16.7	35.7	30	40	32.3
Note: Upper Case	66.7	90.9	75	70.6	87.5	63.6	88.2	50	71.4	90	94	75.8
Lower Case	0	36.4	25	8.8	75	36.4	0	33.3	21.4	30	26	21.0
Combination Upper & Lower	11.1	36.4	25	8.8	75	54.5	11.8	16.7	21.4	30	30	24.2
Lettering Instruments	66.7	90.9	25	35.3	87.5	54.5	29.4	50	50	50	62	50
PROJECTION												
Orthographic	66.7	45.5	75	76.5	62.5	36.4	82.4	66.7	50	50	79	63.7
Axonometric	55.6	9.1	50	41.2	25	27.3	41.2	83.3	35.7	30	47	37.9
Oblique	11.1	18.2	0	17.6	12.5	9.1	5.9	50	14.3	40	21	16.9
Perspective	44.4	9.1	25	17.6	50	27.3	11.8	50	35.7	40	33	26.6
Coordinate System of Point Projection	11.1	27.3	0	26.5	75	27.3	41.2	33.3	28.6	50	40	32.3
TECHNICAL SKETCHING												
Design Sketching	77.8	63.6	75	73.5	62.5	54.5	64.7	66.7	71.4	60	84	67.7
Freehand Sketching	44.4	27.3	50	50	62.5	72.7	29.4	66.7	35.7	40	57	46.0
INTERSECTIONS & DEVELOPMENT												
Plane Surfaces	66.7	72.7	25	64.7	50	45.5	70.6	16.7	57.1	50	72	58.1
Curved Surfaces	66.7	54.5	0	64.7	50	45.5	64.7	33.3	64.3	40	69	55.6
Lines	66.7	72.7	25	73.5	62.5	54.5	70.6	66.7	71.4	60	83	66.9

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GEARS & CAMS	%	%	%	%	%	%	%	%	%	%	No.	%
Detailed Gear Drawing	0	0	0	32.4	0	9.1	41.2	0	14.3	20	23	18.5
Gear Calculates	0	0	0	29.4	0	0	29.4	0	14.3	20	19	15.3
Cam Displacement Diagrams	0	0	0	29.4	0	9.1	17.6	0	14.3	20	19	15.3
STRUCTURES												
Architectural Drawing	100	63.6	25	20.6	12.5	54.5	17.6	83.3	85.7	100	62	50
Structural Details	100	100	25	38.2	12.5	36.4	35.3	100	92.9	100	74	59.7
Presentations	77.8	81.8	25	35.3	75	72.7	29.4	50	57.1	100	69	55.6
Models	33.3	18.2	0	26.5	0	27.3	5.9	50	35.7	30	29	23.4
Size Coordination by Grid	11.1	45.5	25	29.4	25	36.4	23.5	50	50	60	43	34.7
Plans	100	100	25	44.1	25	72.7	35.3	100	92.9	100	81	65.3
Elevations	100	90.9	25	44.1	37.5	72.7	29.4	100	85.7	100	79	63.7
Job Specification	88.9	81.8	25	44.1	0	72.7	29.4	83.3	92.9	80	72	58.1
ELECTRICAL SYSTEMS												
Graphic Symbols	44.4	45.5	100	91.2	0	45.5	70.6	33.3	35.7	90	77	62.1
Layout of Diagrams	55.6	54.5	100	91.2	0	45.5	64.7	33.3	50	90	80	64.5
Representation of Contacts & Terminals	11.1	45.5	75	94.1	0	36.4	47.1	33.3	42.9	70	68	54.8
Schematics	44.4	54.5	100	97.1	0	45.5	70.6	33.3	50	90	82	66.1
Printed Circuits	0	27.3	75	73.5	0	18.2	35.3	0	28.6	30	46	37.1
Job Specification	44.4	54.5	100	76.5	0	45.5	47.1	33.3	42.9	50	66	53.2

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PIPING	%	%	%	%	%	%	%	%	%	%	No.	%
Metal Pipe	55.6	54.5	0	50	12.5	45.5	41.2	100	50	70	61	49.2
Tubing	55.6	45.5	25	52.9	12.5	18.2	58.8	100	50	70	62	50
Plastic Pipe	44.4	54.5	0	29.4	0	18.2	17.6	83.3	35.7	50	40	32.3
Pipe & Tube Joints, Fittings, & Valves	33.3	45.5	25	44.1	12.5	36.4	47.1	100	42.9	70	56	45.2
Job Specifications	44.4	45.5	25	47.1	12.5	36.4	47.1	100	57.1	70	60	48.4
Threads & Their Specifications	22.2	18.2	0	41.2	0	0	82.4	50	35.7	10	41	33.1
Pipe Drawings	55.6	54.5	25	41.2	12.5	45.5	47.1	100	28.6	90	59	47.6
Hanger & Support Drawings	55.6	9.1	25	35.3	12.5	27.3	17.6	100	50	70	46	37.1
MAPS & TOPOGRAPHY												
Survey Plats	88.9	90.9	25	20.6	87.5	81.8	11.8	66.7	57.1	90	65	52.4
Industrial Plats	66.7	81.8	25	17.6	12.5	72.7	11.8	50	35.7	90	47	37.9
Subdivision Plats	44.4	72.7	0	11.8	25	63.6	5.9	50	35.7	30	37	29.8
City Plats	55.6	81.8	0	11.8	25	45.5	0	50	35.7	30	36	29.0
Topographic Drawings	88.9	90.9	25	20.6	100	90.9	5.9	66.7	50	80	64	51.6
Topographic Symbols	88.9	90.9	25	14.7	87.5	81.8	5.9	50	50	80	59	47.6
Landscape Maps	55.6	54.5	0	17.6	37.5	54.5	11.8	0	42.9	10	35	28.2
Profiles	77.8	100	25	20.6	100	63.6	5.9	50	50	90	61	49.2
SECTIONS & CONVENTIONS												
Principles of Sectioning	77.8	81.8	75	85.3	62.5	27.3	94.1	83.3	57.1	80	93	75
Types of Sectional View:												
Full Section	88.9	81.8	50	88.2	62.5	27.3	94.1	83.3	92.9	70	98	79.0
Half Section	66.7	72.7	50	88.2	37.5	27.3	94.1	83.3	71.4	60	89	71.8
Revolved Section	11.1	27.3	25	70.6	25	27.3	82.4	50	57.1	60	65	52.4
Removed Section	0	36.4	25	73.5	12.5	18.2	88.2	50	64.3	60	66	53.2

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DIMENSIONS	%	%	%	%	%	%	%	%	%	%	No.	%
Fractional Dimensions	77.8	81.8	75	41.2	12.5	54.5	58.8	83.3	64.3	100	74	59.7
Decimal Dimensions	44.4	90.9	75	91.2	25	36.4	100	50	50	60	83	66.9
Tolerance of Limits	33.3	18.2	75	91.2	25	18.2	94.1	33.3	35.7	40	70	56.5
Classifications of Fits	22.2	18.2	50	76.5	0	18.2	58.8	33.3	28.6	20	52	41.9
Geometric Dimensioning	0	9.1	50	61.8	0	18.2	64.7	16.7	14.3	30	43	34.7
Speed Dimensioning	11.1	9.1	50	35.3	0	18.2	17.6	16.7	14.3	40	28	22.6
Unidirectional Dimensioning	0	18.2	75	50	0	36.4	64.7	50	42.9	40	50	40.3
Aligned Dimensioning	44.4	36.4	75	47.1	0	9.1	52.9	50	50	50	52	41.9
SCREWS, THREADS, FASTENERS, KEYS, & SPRINGS												
Terminology	44.4	18.2	75	79.4	0	18.2	88.2	33.3	35.7	50	65	52.4
Thread Form	0	9.1	50	64.7	0	18.2	76.5	16.7	21.4	20	46	37.1
Thread Symbols	11.1	9.1	50	64.7	0	18.2	70.6	33.3	35.7	30	50	33.3
Thread Specifications	22.2	18.2	50	79.4	0	21.4	70.6	16.7	28.6	20	55	44.4
Fastener Specification	33.3	27.3	50	79.4	0	18.2	76.5	16.7	42.9	20	59	47.6
Locking Device Specifications	33.3	18.2	0	70.6	0	9.1	64.7	16.7	35.7	20	49	39.5
Keys	33.3	9.1	0	55.9	0	9.1	70.6	33.3	21.4	20	43	34.7
Springs	11.1	0	0	55.9	0	9.1	70.6	33.3	21.4	20	40	32.3

TABLE I

NUMBER & PERCENTAGE OF POSITIVE RESPONSES TO QUESTIONNAIRE
BY ITEM AND BY TECHNOLOGICAL AREA

	ARCHITECTURAL N=9	CIVIL N=11	ELECTRICAL N=4	ELECTRO-MECHANICAL N=34	GEOLOGICAL N=8	GEOLOGICAL CARTOGRAPHY N=11	MECHANICAL N=17	PIPING N=6	STRUCTURAL N=14	ALL RESPONSIBILITIES N=10	TOTAL N=124	
CHARTS	%	%	%	%	%	%	%	%	%	%	No.	%
Rectilinear Charts	33.3	18.2	50	14.7	62.5	18.2	5.9	16.7	14.3	30	26	21.0
Bar Charts	44.4	63.6	50	20.6	62.5	63.6	23.5	50	35.7	70	51	41.1
Pie Charts	11.1	36.4	50	14.7	25	34.5	0	33.3	14.3	60	30	24.2
Strata & Volume	11.1	36.4	25	11.8	62.5	45.5	0	33.3	14.3	40	28	22.6
Pictorial	22.2	27.3	25	26.5	62.5	45.5	11.8	16.7	21.4	50	36	29.0
Logarithmic Scale	11.1	18.2	0	11.8	75	45.5	11.8	16.7	21.4	30	27	21.8
Semilogarithmic Charts	0	18.2	0	11.8	62.5	36.4	0	16.7	14.3	20	20	16.1
Logarithmic Charts	0	18.2	0	11.8	62.5	45.5	5.9	33.3	21.4	30	25	20.2
Polar Charts	0	18.2	50	5.9	12.5	27.3	5.9	16.7	14.3	20	16	12.9
Trilinear Charts	0	18.2	0	5.9	25	18.2	0	16.7	14.3	10	12	9.7
WELDING & RIVET SYMBOLS												
Welding Symbols	66.7	72.7	25	73.5	0	18.2	82.4	66.7	78.6	90	80	64.5
Rivet Symbols	11.1	35.3	0	35.3	0	0	5.9	16.7	21.4	20	20	16.7

TABLE II
NUMBER & PERCENTAGE OF POSITIVE RESPONSES TO QUESTIONNAIRE
BY ITEM AS COMPARED TO TEXT AND CURRICULUM GUIDE CONTENT

INSTRUMENTS	QUESTIONNAIRE TOTAL N=124		CURRICULUM GUIDE CONTENT	TEXTBOOK TOTAL N=9		TEXTBOOKS GOOD CONTENT N=9		TEXTBOOKS LITTLE CONTENT N=9	
	No.	%		No.	%	No.	%	No.	%
Drafting Tape	69	55.6		5	55.6	4	44.4	1	11.1
Tumbtacks	0	0		3	33.3	0	0	3	33.3
Templates	106	85.5	X	7	77.8	2	22.2	5	55.6
Alphabet of Lines	56	45.2	X	6	66.7	6	66.7	0	0
Proportional Dividers	24	19.4	X	3	33.3	0	0	3	33.3
Pencil Pointer	63	50.8	X	7	77.8	3	33.3	4	44.4
Wood Pencil	12	9.7	X	5	55.6	3	33.3	2	22.2
Mechanical Pencil	94	75.8	X	5	55.6	2	22.2	3	33.3
Pencil Tracing	52	41.9	X	2	22.2	0	0	2	22.2
SCALES									
Metric Scales	31	25	X	5	55.6	2	22.2	3	33.3
Engineers Scales	92	74.2		3	33.3	2	22.2	1	11.1
Architects Scale	70	56.5	X	7	77.8	6	66.7	1	11.1
Decimal Scales	60	48.4	X	6	66.7	4	44.4	2	22.2
Mechanical Engineers Scales	46	37.1	X	5	55.6	5	55.6	0	0
Drafting Machines	89	71.8	X	6	66.7	3	33.3	3	33.3
Parallel Bars	40	32.3	X	5	55.6	0	0	5	55.5
Drawing Paper	92	74.2	X	5	55.6	5	55.6	0	0
INKING									
Technical Pen	77	62.1	X	5	55.6	1	11.1	4	44.4
Tracing in Ink	55	44.4		2	22.2	0	0	2	22.2

TABLE II
NUMBER & PERCENTAGE OF POSITIVE RESPONSES TO QUESTIONNAIRE
BY ITEM AS COMPARED TO TEXT AND CURRICULUM GUIDE CONTENT

	QUESTIONNAIR TOTAL N=124		CURRICULUM GUIDE CONTENT	TEXTBOOK TOTAL N=9		TEXTBOOKS GOOD CONTENT N=9		TEXTBOOKS LITTLE CONTENT N=9	
LETTERING	No.	%		No.	%	No.	%	No.	%
Guide Lines	78	59.7	X	6	66.7	6	66.7	0	0
Vertical Letters	70	56.5	X	8	88.9	6	66.7	2	22.2
Slant Letters	40	32.3	X	8	88.9	6	66.7	2	22.2
Notes: Upper-Case	94	75.8	X	8	88.9	6	66.7	2	22.2
Lower-Case	26	21.0	X	8	88.9	4	44.4	4	44.4
Combination Lower & Upper	30	24.2		4	44.4	0	0	4	44.4
Lettering Instruments	62	50	X	8	88.9	3	33.3	5	55.5
PROJECTION									
Orthographic	79	63.7	X	7	77.8	7	77.8	0	0
Axonometric	47	37.9	X	7	77.8	6	66.7	1	11.1
Oblique	21	16.9	X	7	77.8	7	77.8	0	0
Perspective	33	26.6	X	6	66.7	6	66.7	0	0
Coordinate System of Point Projection	40	32.3		2	22.2	2	22.2	0	0
TECHNICAL SKETCHING									
Design Sketching	84	67.7		5	55.6	2	22.2	3	33.3
Freehand Detailing	57	46.0	X	8	88.9	5	55.6	3	33.3
INTERSECTIONS & DEVELOPMENT									
Plane Surfaces	72	58.1		7	77.8	6	66.7	1	11.1
Curved Surfaces	69	55.6		7	77.8	6	66.7	1	11.1
Lines	83	66.9		5	55.6	5	55.6	0	0
GEARS & CAMS									
Detailed Gear Drawings	23	18.5		7	77.8	5	55.6	2	22.2
Gear Calculates	19	15.3		6	66.7	5	55.6	1	11.1
Cam Displacement Diagrams	19	15.3		5	55.6	4	44.4	1	11.1

TABLE II
NUMBER & PERCENTAGE OF POSITIVE RESPONSES TO QUESTIONNAIRE
BY ITEM AS COMPARED TO TEXT AND CURRICULUM GUIDE CONTENT

	QUESTIONNAIR TOTAL N=124		CURRICULUM GUIDE CONTENT	TEXTBOOK TOTAL N=9		TEXTBOOKS GOOD CONTENT N=9		TEXTBOOKS LITTLE CONTENT N=9	
STRUCTURES	No.	%		No.	%	No.	%	No.	%
Architectural Drawings	62	50		2	22.2	2	22.2	0	0
Structural Details	74	59.7		2	22.2	2	22.2	0	0
Presentations	69	55.6		2	22.2	1	11.1	1	11.1
Models	29	23.4		1	11.1	1	11.1	0	0
Size Coordination by Grid	43	34.7		1	11.1	1	11.1	0	0
Plans	81	65.3		2	22.2	2	22.2	0	0
Elevations	79	63.7		2	22.2	2	22.2	0	0
Job Specifications	72	58.1		0	0	0	0	0	0
ELECTRICAL SYSTEMS									
Graphic Symbols	77	62.1		7	77.8	7	77.8	0	0
Layout of Diagrams	80	64.5		6	66.7	1	11.1	5	55.6
Representation of Contacts & Terminals	68	54.8		4	44.4	2	22.2	2	22.2
Schematics	82	66.1		6	66.7	3	33.3	3	33.3
Printed Circuits	46	37.1		5	55.6	1	11.1	4	44.4
Job Specifications	66	53.2		0	0	0	0	0	0
PIPING									
Metal Pipe	61	49.2		5	55.6	0	0	5	55.6
Tubing	62	50		4	44.4	0	0	4	44.4
Plastic Pipe	40	32.3		1	11.1	0	0	1	11.1
Pipe & Tube Joints, Fittings, & Valves	56	45.2		5	55.6	1	11.1	4	44.4
Job Specifications	60	48.4		1	11.1	0	0	1	11.1
Threads & Their Specifications	41	33.1		4	44.4	1	11.1	3	33.3
Pipe Drawings	59	47.6		4	44.4	1	11.1	3	33.3
Hanger & Support Drawings	46	37.1		0	0	0	0	0	0

TABLE II
NUMBER & PERCENTAGE OF POSITIVE RESPONSES TO QUESTIONNAIRE
BY ITEM AS COMPARED TO TEXT AND CURRICULUM GUIDE CONTENT

	QUESTIONNAIR TOTAL N=124		CURRICULUM GUIDE CONTENT	TEXTBOOK TOTAL N=9		TEXTBOOKS GOOD CONTENT N=9		TEXTBOOKS LITTLE CONTENT N=9	
MAPS & TOPOGRAPHY	No.	%		No.	%	No.	%	No.	%
Survey Plats	65	52.4		5	55.6	1	11.1	4	44.4
Industrial Plats	47	37.9		3	33.3	0	0	3	33.3
Subdivision Plats	37	29.8		4	44.4	0	0	4	44.4
City Plats	36	29.0		4	44.4	1	11.1	3	33.3
Topographic Drawings	64	51.6		5	55.6	2	22.2	3	33.3
Topographic Symbols	59	47.6		5	55.6	5	55.6	0	0
Landscape Maps	35	28.2		4	44.4	1	11.1	3	33.3
Profiles	61	49.2		6	66.7	2	22.2	4	44.4
SECTIONS & CONVENTIONS									
Principles of Sectioning	93	75.0	X	8	88.9	5	55.6	3	33.3
Types of Section Views:									
Full Section	98	79.0	X	9	100	3	33.3	6	66.7
Half Section	89	71.8	X	9	100	3	33.3	6	66.7
Revolved Section	65	52.4	X	9	100	3	33.3	6	66.7
Removed Section	66	53.2	X	8	88.9	3	33.3	5	55.6
DIMENSIONS									
Fractional Dimensions	74	59.7	X	7	77.8	2	22.2	5	55.6
Decimal Dimensions	83	66.9	X	8	88.9	5	55.6	3	33.3
Tolerance of Limits	70	56.5	X	8	88.9	5	55.6	3	33.3
Classification of Fits	52	41.9	X	7	77.8	5	55.6	2	22.2
Geometric Dimensioning	43	34.7		5	55.6	5	55.6	0	0
Speed Dimensioning	28	22.6		0	0	0	0	0	0
Unidirectional Dimensioning	50	40.3	X	8	88.9	2	22.2	6	66.7
Aligned Dimensioing	52	41.9	X	8	88.9	2	22.2	6	66.7

TABLE II
NUMBER & PERCENTAGE OF POSITIVE RESPONSES TO QUESTIONNAIRE
BY ITEM AS COMPARED TO TEXT AND CURRICULUM GUIDE CONTENT

	QUESTIONNAIR TOTAL N=124		CURRICULUM GUIDE CONTENT	TEXTBOOK TOTAL N=9		TEXTBOOKS GOOD CONTENT N=9		TEXTBOOKS LITTLE CONTENT N=9	
SCREW THREADS, FASTENERS, KEYS, & SPRINGS	No.	%		No.	%	No.	%	No.	%
Terminology	65	52.4		9	100	6	66.7	3	33.3
Thread Forms	46	37.1		9	100	5	55.6	4	44.4
Thread Symbols	50	33.3		9	100	5	55.6	4	44.4
Thread Specifications	55	44.4		7	77.8	3	33.3	4	44.4
Fasteners Specifications	59	47.6		8	88.9	3	33.3	5	55.6
Locking Device Specification	49	39.5		6	66.7	3	33.3	3	33.3
Keys	43	34.7		8	88.9	4	44.4	4	44.4
Springs	40	32.3		7	77.8	3	33.3	4	44.4
CHARTS									
Rectilinear Chart	26	21.0		4	44.4	2	22.2	2	22.2
Bar Chart	51	41.1		6	66.7	2	22.2	4	44.4
Pie Chart	30	24.2		6	66.7	2	22.2	4	44.4
Strata & Volume	28	22.6		2	22.2	0	0	2	22.2
Pictorial	36	29.0		3	33.3	0	0	3	33.3
Logarithmic Scales	27	21.8		3	33.3	1	11.1	2	22.2
Semilogarithmic Chart	20	16.1		4	44.4	1	11.1	3	33.3
Logarithmic Charts	25	20.2		4	44.4	1	11.1	3	33.3
Polar Charts	16	12.9		5	55.6	1	11.1	4	44.4
Trilinear Charts	12	9.7		4	44.4	0	0	4	44.4
WELDING & RIVETING									
Welding Symbols	80	64.5		8	88.9	7	77.8	1	11.1
Rivet Symbols	20	16.7		6	66.7	5	55.6	1	11.1

*From the survey the drafters were asked which items listed in Table I should be de-emphasized or eliminated. The following is a consensus of their opinions by technological area.

ITEMS WHICH SHOULD BE DE-EMPHASIZED IN THE DESIGN-DRAFTING CURRICULUM.

Civil
- Metric
- Wood Pencils
- Use of ruling pen

Electrical
- None

Geological
- None

Structural
- Mechanical drafting and tool design
- Belts chains and drives- Remove (jigs and fixtures, charts, graphs, mapping) Plastic moulds-castings also steel
- Because we're in wood furniture we would have no use for - Gears and cams; piping; maps and topography; charts; screw threads
- Stick to basics in all fields. I have both in mechanical and architectural- I wish I had more- electrical, plumbing
- Rivets are no longer used for structural steel

Mechanical
- Charts, Inking
- Structures and topography
- *Architectural
- No-not until the drafter decides what area he (or) she is going into, then item could be de-emphasized accordingly.
- None to my knowledge
- Charts
- Heavy inking not needed

All Responsibilities
- References to archic tools such as ruling pen. De-emphasize machine parts in favor of other disciplines.
- Architectural
- Instruction in machine design type drafting is of little or no use in the typical A/E practice.
- Less emphasis on information that can be covered in the spec's.
- Technical sketching and architectural drafting

Piping
- All of the items are very important to one drafting field or another
- Detailed hear and thread calculations and drawings
- Has been too long since I looked at the curriculum.
- The variety of curriculum listed above is necessary for a good background in the engineering field.

Architectural
- My professional and educational career has been in architectural only
- Much of AIDD seems to relate to mechanical and machine design
- In the arch. area most text books are outdated and too much on lettering and STD. charts-showed refer to reference books
- Use of T-square, 45-30-60 triangle combo's and wood drawing pencils

Geological-Cartography

Less emphasis upon freehand lettering due to media available via computer graphics, dry transfer, etc.
Architectural drafting
Intersections and developments

Electro-Mechanical

Fasteners, screw threads, keys, and springs
Sectioning by material; other than basic lettering
Riveting, parallel bars, thumbtacks
Charts, maps and topography
Old fashioned drawing instruments- T-square, compasses, wood pencils, old style mechanical pencils, things used seldom in the field.
Personally I feel that maps and topography is a subject that is better emphasized in geography and need not be a major part of industrial drafting.
A great many depends on specified field of training.
Too much time is spent teaching architectural in drafting schools. Where the job market calls for electro-mechanical.
Develop curriculum that will allow students to specialize in a particular field and de-emphasize the unrelated fields. Mechanical draftsman doesn't need map drafting, etc.
Hand lettering, linework quality, alternate dim. systems other than geometric tolerancing, general forms of drafting unrelated to the speciality field they are training for (ie: perspective view...etc. for E/M specialty)
Inking, charts, structures, maps, topography, piping

PROCEDURES

The following procedures were followed in identifying the population and the collection of data:

1. The national office of the American Institute of Design Drafting was contacted to get a list of the names and addresses of the random sample of individuals who would be used as a population in the study.
2. A questionnaire was developed that was designed to gain the data in order to reach the study objectives.
3. A cover letter was written and approved and signed by the president of AIDD on AIDD letterhead stationery.
4. The questionnaire was sent to the population.
5. The data was collected and analyzed.
6. The final report was prepared.

aidd
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July 30, 1982

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Dear AIDD Member:

The problem of determining what drafting and design trainees need in skills and knowledge to become a valuable employee is the primary question of teachers who supervise the trainee's development. In recent inquiries of publishers and authors, or text materials that may be used as references in this training process, it was found that little or no research had been done to ensure that the information found in common texts was indicative of the needs of current drafting workers. The enclosed questionnaire, written by Southwest Missouri State University and endorsed by AIDD, is an attempt to determine if the content of training texts for drafting and design contain the information needed by industry, that all areas are included that may be needed, and the proper emphasis on specifics is compatible to the needs of industry.

The data collected will be kept confidential as to who was included in the population of the survey. Your responses will be analyzed as grouped data ensuring your anonymity.

Enclosed you will find the survey questionnaire and a self-addressed post-paid envelope. The little time it takes to complete the questionnaire will be very valuable to the profession. Thank you.

Sincerely,

Richard E. Jones
AIDD President

Richard E Jones

Eugene Sherrell
Project Director

Eugene Sherrell

REJ/krp

Enclosure

NATIONAL SURVEY OF DRAFTING IN INDUSTRY

NAME OF COMPANY_____DATE_____

ADDRESS OF COMPANY_____

PERSON FILLING OUT FORM_____

TITLE OF PERSON FILLING OUT FORM_____

PRODUCT OR SERVICES OF EMPLOYER_____

Check one item in each of column (1) & (2) below that most nearly describes your company's function as it relates to you.

COLUMN (1)

_____Government
_____Manufacturing
_____Research and Development
_____Sales
_____Services
_____Other_____

COLUMN (2)

_____Aerospace
_____Communication
_____Electronics
_____Mechanical
_____Retail
_____Other_____

YOUR RESPONSIBILITY IN THE COMPANY

Check one item below that most nearly describes your function within the company.

_____Administrator
_____Drafter
_____Supervisor

Check one item below that most nearly describes your responsibility within your company in the major area of drafting or graphics.

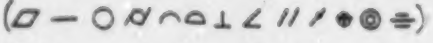
_____Civil
_____Electrical
_____Electro-Mechanical
_____Geological
_____Pipe Designers
_____Piping
_____Piping-Electrical
_____Mechanical
_____Structural
_____Other_____

DIRECTIONS: Included below are categories of concern in the design - drafting field. Please indicate the amount of importance each item is to you in doing your job in your company. You may do so by placing a check mark (✓) in the appropriate box to the right of the item. Please do not leave any item blank.. Thank you.

Instruments	NO IMPORTANCE	MINOR IMPORTANCE	IMPORTANT	MAJOR IMPORTANCE
Drafting tape to hold sheet				
Thumbtacks to hold sheet				
Templates				
Alphabet of lines				
Proportional dividers				
Pencil pointer				
Wood pencil				
Mechanical pencils				
Pencil tracing				

	NO IMPORTANCE	MINOR IMPORTANCE	IMPORTANT	MAJOR IMPORTANCE
Metric scales				
Engineers scales				
Architects scales				
Decimal scale				
Mechanical engineers scale				
Drafting machines				
Parallel bars				
Drawing paper (Type)_____				
Other _____				
Inking				
Technical pen				
Tracing in ink				
Lettering				
Guide lines				
Vertical letters				
Slant (inclined) letters				
Notes: Upper-case letters				
Lower-case letters				
Combination lower and upper				
Lettering instruments (Kind)_____				
Projection				
Orthographic				
Axonometric (Isometric, dimetric, trimetric)				
Oblique				
Perspective				
Coordinate system of point projection				
Technical Sketching				
Design sketching				
Freehand detailing				
Intersections and Development				
Plane surfaces				
Curved surfaces				
Lines				

	NO IMPORTANCE	MINOR IMPORTANCE	IMPORTANT	MAJOR IMPORTANCE
Gears and Cams				
Detailed gear drawings.				
Gear calculates				
Cam displacement diagrams				
Structures				
Architectural drawings.				
Structural details.				
Presentations				
Models.				
Size coordination by grid				
Plans				
Elevations.				
Job specification				
Electrical Systems				
Graphic symbols				
Layout of diagrams.				
Representation of contacts and terminals				
Schematics.				
Printed circuits				
Job specificiations				
Pipies				
Metal pipe (size and standard)				
Tubing (size and standard)				
Plastic pipe				
Pipe and tube joints, fittings, and valves.				
Job specification				
Threads and their specification				
Pipe drawings				
Hanger and support drawings				
Maps and Topography				
Survey plats				
Industrial plats				
Subdivision plats				
City plats.				
Topographic drawings				
Topographic symbols				
Landscape maps.				
Profiles				

	NO IMPORTANCE	MINOR IMPORTANCE	IMPORTANT	MAJOR IMPORTANCE
Sections and Conventions				
Principles of sectioning				
Types of sectional views: Full section				
Half section				
Revolved section				
Removed section.				
Dimensions				
Fractional dimensions				
Decimal dimensions.				
Tolerance of limits				
Classification of fits.				
Geometric dimensioning 				
Speed dimensioning.				
Unidirectional dimensioning				
Aligned dimensioning				
Screw Threads, Fasteners, Keys, and Springs				
Terminology				
Thread forms				
Thread symbols.				
Thread specifications				
Fasteners specifications				
Locking device specifications				
Keys				
Springs				
Charts				
Rectilinear chart				
Bar chart				
Pie chart				
Strata and volume				
Pictorial				
Logarithmic scales.				
Semilogarithmic charts.				
Logarithmic charts.				
Polar charts				
Trilinear charts				

	NO IMPORTANCE	MINOR IMPORTANCE	IMPORTANT	MAJOR IMPORTANCE
Welding and Riveting				
Welding symbols				
Rivet symbols				

All of the items in the check list above are emphasized in textbooks and training institutions in the area of design-drafting.

In your opinion are there any items which could be pulled or de-emphasized in the curriculum of design-drafting? (List)

_____

_____

In your opinion are there any items which should be added to the curriculum of design-drafting? (List)

_____

_____

Please answer the questions with either a check mark (✓) or short answer.

Have computer drafting techniques been incorporated in your company's design-drafting department?

_____Yes _____No

If yes, what is the manufacture's name and number of your system?

_____

_____

For what is the system being used?

_____Graphics
_____Structural D-afting
_____System Engineering
_____Word Processing
_____Other_____

_____

Where are computer-drafting personnel obtained?

_____Design-drafting
_____Computer-services
_____Other_____

Who makes the best computer-design-drafting employee?

_____Drafting background
_____Computer background
_____Other_____

If you do not use the computer do you foresee the incorporation of computer drafting in the next five years?

_____Yes _____No

Are metrics currently being used extensively in your company's design-drafting and graphics department?

_____Yes _____No

In your opinion will metrics be used more in the next five years?

_____Yes _____No

In your opinion who makes the better trainee? A person with

_____some drafting experience
_____no drafting experience
_____high school diploma
_____some college
_____college degree
_____Other_____

Is there a shortage of drafters or designers in your area of drafting?

_____Yes _____No

Is there a shortage of drafters or designers in your company?

_____Yes _____No

GENERAL COMMENTS: